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(54) **APPARATUS FOR DUST REMOVAL BY AIR CURTAIN ISOLATION AND SELF-CIRCULATION PURIFICATION**

(57) The invention relates to a device for dust removal through air curtain isolation and self-circulation purification, comprises a material input transferring cabin (1), a main isolation cabin (2), a material output transferring cabin (3) and a control cabinet (7). Three independent interlayer isolation cabins are provided. A self-circulation purification device formed of self-circulation air pipes with a plug-board coarse-efficiency filter and a plug-board medium-efficiency filter is disposed in the main isolation cabin, and an airflow cleaning air curtain formed of an inlet airflow air curtain passage and an outlet airflow air curtain passage is respectively disposed between the main isolation cabin and the material input transferring cabin and between the main isolation cabin and the material output transferring cabin. Dust from the processing equipment is removed at the moment when it is produced by means of air curtain isolation and self-circulation purification..

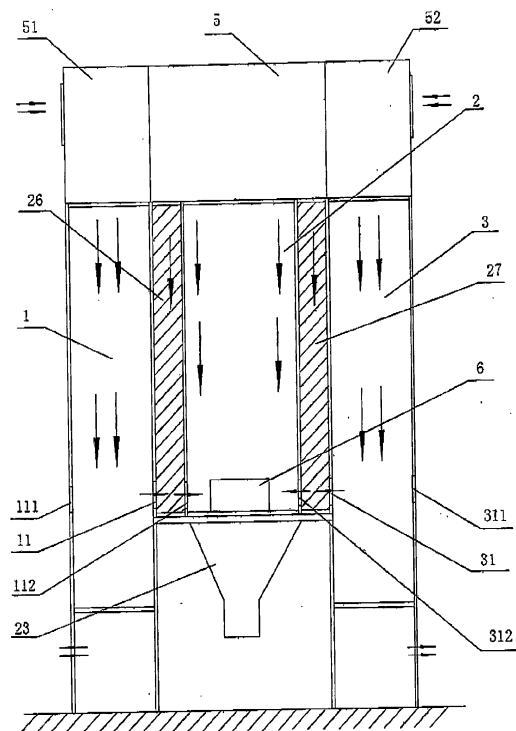


Figure 1

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Description

Field of the Invention

[0001] The invention relates to a cleaning and isolation facility for pharmaceutical processing equipment, in particular to a device for dust removal through air curtain isolation and self-circulation purification, applied in a pharmaceutical clean area (i.e., pharmaceutical clean room) to be able to guarantee sterile unidirectional flow inside the isolation facility and also prevent dust and aerosol produced by the pharmaceutical processing equipment during running from resulting in pollution and interference to the environment of both the processing area and the whole clean area.

Description of the Prior Art

[0002] For pharmaceutical enterprises, dust produced by equipment, for example a capping machine running in the clean area, will result in pollution and interference to the environment of both the processing area and the whole clean area. The capping machine is equipment for sealing drug containers, which have been filled and stoppered or have been freeze-dried and corked, by an aluminum cap and aluminum plastics. After a drug container has been filled and stoppered but before capped and sealed, the connection between the rubber stopper and the bottleneck is in an Incomplete Seal status, there is a possibility of losing even bouncing of the stopper. The capping machine in a capping workshop during capping will produce a lot of suspended aluminum scraps, glass chips, aerosol and other kinds of dust, which are difficult to detect. Such dust produced by the capping machine constitutes a serious pollution threat to the sterile status of the capping workshop area. Meanwhile, such dust will spread around through the purification and air-conditioning system of the whole clean area, thereby resulting in extensive pollution to the environment of the whole clean area for pharmaceutical manufacturing and interference to the purification and air-conditioning system of the clean area.

[0003] The Minimum Requirement on capping of non-terminally sterilized products in Chinese GMP (Good Manufacturing Practice) Version 1998 is Grade 100,000 (Grade D). The GMP Version 2010 revised by the State Food and Drug Administration specifies that capping of non-terminally sterilized products must be done in a Grade A environment under Grade B background. However, in the prior art, the requirements in the new version of GMP cannot be met due to the pollution of aluminum scraps, glass chips and aerosol to the capping workshop. Generally, most pharmaceutical enterprises place the capping machine in a Grade 100 laminar hood in a Grade 100,000 capping workshop for running, as a result, the cleanness of the capping area is difficult to meet the standard requirements. Dust, particles and aerosol may also be produced during other procedures of pharma-

ceutical manufacturing, for example, during the processing and sub-packaging of bacterial and virus species, contraceptives, antineoplastic drugs, radiochemicals and highly toxic products, in addition to the foregoing capping and sealing procedures of pharmaceutical manufacturing, thereby resulting in pollution and interference to operators and the environment of the whole clean area. Therefore, the prior art has problems and deficiencies that the cleanness of the environment of the pharmaceutical processing area is difficult to meet the standard requirements.

Summary of the Invention

[0004] It is an object of the present invention to provide a device for dust removal through air curtain isolation and self-circulation purification, in order to isolate dust produced by the processing equipment in the area where it is produced and remove the dust at the moment when it is produced by means of air curtain isolation and self-circulation purification, thereby avoiding the spreading of dust resulting in pollution and interference to the environment of both the processing area and the whole clean area and facilitating the cleanness of the pharmaceutical processing environment to meet the standard requirements in the Chinese GMP Version 2010.

[0005] For achieving the above stated object, a device, for dust removal through air curtain isolation and self-circulation purification, comprises a material input transferring cabin;

[0006] a main isolation cabin, having a front wall, a back wall, a left wall, and a right wall, for placing and isolating a processing equipment which is placed inside the main isolation cabin, each wall has a top and a bottom, the main isolation cabin being connected to the material input transferring cabin through a material inlet that is formed on a wall between the main input transferring cabin and the main isolation cabin; a material output transferring cabin connected to the main isolation cabin through a material outlet that is formed on a wall between the main isolation cabin and the material output transferring cabin; and

[0007] a control cabinet containing an automatic control device for adjusting, displaying, and recording air volume, pressure differential, and a number of suspended particles in the main isolation cabin, the material input transferring cabin, and the material output transferring cabin;

[0008] characterized in that, the main isolation cabin is a sealed cabin surrounded by walls, the material input transferring cabin and the material output transferring cabin are respectively disposed on left side and right side of the main isolation cabin, a material input hole is formed on a left wall of the material input transferring cabin, a material output hole is formed on a right wall of the material output transferring cabin; a first laminar flow filtering hood, a second laminar flow filtering hood and a third laminar flow filtering hood connect to and seal respec-

tively a top of the main isolation cabin, a top of the material input transferring cabin, and a top of the material output transferring cabin, the first laminar flow filtering hood has an air supply surface, a first air inlet is formed on a side-wall of the second laminar flow filtering hood and a second air inlet is formed on a sidewall of the third laminar flow filtering hood, a first air passage is formed between a bottom of the material input transferring cabin and the ground, a second air passage is formed between a bottom of the material output transferring cabin and the ground;

[0009] a self-circulation air pipe with a lower end and an upper end is vertically attached to the front wall of the main isolation cabin, a waste container with an open top and a lower interface is placed inside the main isolation cabin below the processing equipment, the lower interface of the waste container enables the main isolation cabin to communicate with the lower end of the self-circulation air pipe;

[0010] a plurality of filters and a fan are placed inside the self circulation air pipe, the upper end of the self-circulation air pipe connects to the first laminar flow filtering hood, and the lower end of the self-circulation air pipe connects to the lower interface of the waste container;

[0011] an inlet reduction spreader plate with a top portion and a lower portion and an outlet reduction spreader plate with a top portion are installed inside the main isolation cabin in parallel with left and right walls of the main isolation cabin respectively, a first gap interlayer is placed between the inlet reduction spreader plate and the left wall of the main isolation cabin forming an inlet spreader air curtain passage, a second gap interlayer is placed between the outlet reduction spreader plate and the right wall of the main isolation cabin forming an outlet spreader air curtain passage, the top portions of the inlet reduction spreader plate and the outlet reduction spreader plate are close to the air supply surface of the laminar flow filtering hood, the lower portions of the inlet reduction spreader plate and the outlet reduction spreader plate are respectively provided with a reduction plate inlet and a reduction plate outlet at positions corresponding to the material inlet and the material outlet.

[0012] Preferably, each wall of the main isolation cabin has a bottom and a plastic plate sealing off the bottom of the four walls to isolate the main isolation cabin from the ground, and, the air passages are formed between the lower portions of the walls of the material input transferring cabin and the material output transferring cabin, excepting the wall adjacent to the main isolation cabin, and the ground.

[0013] Preferably, the filters in the self-circulation air pipe comprise a plug-board coarse-efficiency filter and a plug-board medium-efficiency filter.

[0014] Preferably, the waste container has a funnel shape and a lower portion for collecting dust of large particles.

[0015] Preferably, a sealed door and a glove box are

disposed on the back wall of the main isolation cabin.

[0016] Preferably, the top of each of the front wall, back wall, left wall, and right wall of the main isolation cabin are sealingly attached to the first laminar flow filtering hood, and only the bottom of the front wall and back wall of the main isolation cabin are sealingly attached to a workbench.

[0017] Preferably, edges of the inlet reduction spreader plate and the outlet reduction spreader plate are respectively sealingly attached to the front wall and back wall of the main isolation cabin.

[0018] Preferably, all the walls are made from transparent glass or transparent organic glass sheets, and the edge of each wall comprises a metal frame.

[0019] For achieving the above stated object, another device, for dust removal through air curtain isolation and self-circulation purification, comprising a material input transferring cabin with a bottom, a main isolation cabin, with a center, a front wall, a back wall, a left wall, and a right wall, each wall has a top and a bottom, attached to the material input transferring cabin and containing an processing equipment, a material output transferring cabin, with a bottom, attached to the main isolation cabin, and a control cabinet attached to the material output transferring cabin;

[0020] characterized in that the main isolation cabin is a sealed cabin surrounded by walls, the material input transferring cabin is disposed on the left side of the main isolation cabin, a material input hole is formed on a left wall of the material input transferring cabin, a material inlet is formed on a wall between the main isolation cabin and the material input transferring cabin and enables communication between the main isolation cabin and the material input transferring cabin;

[0021] the material output transferring cabin is disposed on right side of the main isolation cabin, a material output hole is formed on a right wall of the material output transferring cabin, and a material outlet is formed on a wall between the main isolation cabin and the material output transferring cabin and enables communication between the main isolation cabin and the material output transferring cabin;

[0022] the control cabinet is an automatic control device for adjusting, displaying, and recording air volume, pressure difference and a number of suspended particles in the main isolation cabin, the material input transferring cabin, and the material output transferring cabin;

[0023] all the walls are made from transparent glass or transparent organic glass sheets, and the edge of each wall comprises a metal frame;

[0024] a first laminar flow filtering hood, a second high-efficiency laminar flow filtering hood and a third high-efficiency laminar flow filtering hood are respectively sealingly attached to top of the main isolation cabin, the material input transferring cabin and the material output transferring cabin, an air inlet is formed on each of the second filtering laminar high-efficiency flow hood and the third high-efficiency laminar flow filtering hood, and a first

air passage is formed between the bottom of the material input transferring cabin and the ground, a second air passage is formed between the bottom of the material output transferring cabin and the ground; the main isolation cabin has four walls, each wall has a bottom, and a plastic plate sealing off the bottoms of the four walls to isolate the main isolation cabin from the ground, and, the air passages are formed between the lower portions of the walls of the material input transferring cabin and the material output transferring cabin, excepting the wall adjacent to the main isolation cabin, and the ground;

[0025] the processing equipment is disposed in the center of the main isolation cabin, a self-circulation air pipe, with a middle, a lower end, and an upper end, is vertically attached to the front wall of the main isolation cabin, a waste container with a top opening is disposed inside the main isolation cabin and below the processing equipment, the waste container, having a caisson shape lower portion for collecting dust of large particles, is provided with a lower interface facing the front wall of the main isolation cabin and allowing communication with a lower end of the self-circulation air pipe;

[0026] the self-circulation air pipe is provided with a plurality of filters and a fan placed respectively at the middle and the upper end of the self-circulation air pipe, the self-circulation air pipe communicates with the first high-efficiency laminar flow filtering hood, and the lower end of the self-circulation air pipe is in communication with the lower interface of the waste container, a sealed door and a glove box are disposed on the back wall of the main isolation cabin;

[0027] the top of each wall of the main isolation cabin is sealing attached to the first high-efficiency laminar flow filtering hood, and the bottoms of the front wall and back wall of the main isolation cabin are sealing attached to a workbench, the top of each of the walls adjacent to the main isolation cabin, the material input transferring cabin and the material output transferring cabin is sealing attached to the first high-efficiency laminar flow filtering hood, but the bottoms of the walls are not sealing attached to a workbench and without providing with the material inlet and the material outlet;

[0028] an inlet reduction spreader plate and an outlet reduction spreader plate are disposed inside the main isolation cabin in parallel, respectively, with the left wall and the right wall of the main isolation cabin, a first gap interlayer is formed between the inlet reduction spreader plate and the left wall of the main isolation cabin and a second gap interlayer is formed between the outlet reduction spreader plate and the right wall of the main isolation cabin, the first gap interlayer and the second gap interlayer form an inlet spreader air curtain passage and an outlet spreader air curtain passage, edges of the inlet reduction spreader plate and the outlet reduction spreader plate are respectively sealing attached to the front wall and back wall of the main isolation cabin, top portions of the inlet reduction spreader plate and the outlet reduction spreader plate are adjacent to an air supply surface on

the high-efficiency laminar flow filtering hood, and lower portions of the inlet reduction spreader plate and the outlet reduction spreader plate are respectively provided with a reduction plate inlet and a reduction plate outlet at positions corresponding to the material inlet and the material outlet;

[0029] The working process of the present invention is as follows:

[0030] During processing, the processing equipment is placed inside the main isolation cabin; and the material is fed into the main isolation cabin through the material input hole, the material input transferring cabin, the material input hole, the inlet spreader air curtain passage and the reduction plate inlet, processed by the processing equipment, and then output from the reduction plate outlet, the outlet spreader air curtain passage and the material outlet through the material output transferring cabin and the material output hole.

[0031] Air flows in each isolation cabin as below: air in the top portion of the clean room is directly extracted by the second laminar flow filtering hood in the material input transferring cabin and the third laminar flow filtering hood in the material output transferring cabin, and then filtered by the respective high-efficiency filters thereof to form a vertically downwards laminar flow which is called the isolation air curtain inside the material input transferring cabin and the material output transferring cabin; and then, the airflow of the isolation air curtain returns back to the clean room from the air passage between the bottom of the material input transferring cabin and the material output transferring cabin, and the ground.

[0032] Dust-contained air inside the main isolation cabin is pumped into the self-circulation air pipe by the fan in the first laminar flow filtering hood, and then filtered by the coarse-efficiency, medium-efficiency and high-efficiency filters to form a vertical laminar flow below the first laminar flow filtering hood, most air enters into the working area of the processing equipment inside the main isolation cabin, a small amount of air forms a vertically downwards laminar flow in the inlet spreader air curtain passage and the outlet spreader air curtain passage due to the spreading of the inlet reduction spreader plate and the outlet reduction spreader plate to form a spreader air curtain, and, the clean air from the spreader air curtain flows downward and is pumped into the main isolation cabin from the reduction plate inlet and a reduction plate outlet, to compensate the spreading loss of the total air supply amount from the first laminar flow filtering hood on the top of the main isolation cabin.

[0033] There may be slight dispersion or mix between the spreader air curtain at the reduction plate inlet and the isolation air curtain inside the material input transferring cabin and also slight dispersion or mix between the spreader air curtain at the reduction plate outlet and the isolation air curtain inside the material output transferring cabin, due to the relatively negative pressure formed between the main isolation cabin and the reduction plate inlet and reduction plate outlet, the clean air from the

isolation air curtain is forced to enter into the main isolation cabin in one direction, thereby guaranteeing a sterile environment inside the main isolation cabin and also isolating and preventing dust produced by the processing equipment in the main isolation cabin from spreading to the clean room; both the dust-contained air at the lower portion of the main isolation cabin and the air supplemented through the reduction plate inlet and reduction plate outlet are pumped into the self-circulation air pipe, then filtered off coarse dust by the plug-board coarse-efficiency filter and the plug-board medium-efficiency filter, and finally filtered by the first laminar flow filtering hood to circularly flow inside the main isolation cabin and the self-circulation air pipe; characterized in that, large particle of dust is collected in the bottom of the waste container, and small particle of dust is filtered off by the plug-board coarse-efficiency filter and the plug-board medium-efficiency filter; in this way, dust produced by the processing equipment is isolated in the area where it is produced and removed at the moment when it is produced.

[0034] The glove box and the sealed door are arranged such that, when the processing equipment needs manual intervention, the operator may perform intervention to the processing equipment in the main isolation cabin through rubber gloves in the glove box; and at the end of processing, the operator may open the sealed door to clean, sterilize and maintain the main isolation cabin and the equipment therein.

[0035] Compared with the prior art, in the present invention,

[0036] for procedures such as capping of non-terminally sterilized products, Annex 1 Sterile Medical Products in the officially issued Chinese GMP Version 2010 (effective on Mar. 3, 2011) is known as "the sterile manufacturing procedures of the following non-terminally sterilized products must be done in Grade A under Grade B background: operating and transporting (filling or encapsulating, sub-packaging, corking, capping, etc.) of products in an Incomplete Seal status, as well as crushing, sieving and etc. of sterile raw materials", and later supplemented by two points: "(1) products are regarded to be in an Incomplete Seal status before capped, (2) due to factors such as the tightness of the corked products, the design of the capping equipment and the property of the aluminum cap, capping may be done in a Grade A air supply environment under Grade C or D background, and the Grade A air supply environment should at least be in accordance with the static requirement of the Grade A area". On this basis, in a case that the device provided by the invention is applied under Grade C or D background, medium-efficiency filters have to be additionally provided at indoor air inlets of the second laminar flow filtering hood and the third laminar flow filtering hood, then the quality of the Grade A vertical laminar flow air and the service life of the high-efficiency filters in each isolation cabin may be guaranteed.

[0037] In addition, the number of the material input

transferring cabins and the material output transferring cabins in the invention may be increased or decrease; or even, the material input transferring cabins and the material output transferring cabins may be integrated, depending on the process requirement.

[0038] In conclusion, by employing a technical solution where three independent interlayer isolation cabins including a main isolation cabin, a material input transferring cabin and a material output transferring cabin are provided, a self-circulation purification device formed of self-circulation air pipes with a plug-board coarse-efficiency filter and a plug-board medium-efficiency filter is disposed in the main isolation cabin, and an airflow cleaning air curtain formed of an inlet airflow air curtain passage and an outlet airflow air curtain passage is respectively disposed between the main isolation cabin and the material input transferring cabin and also between the main isolation cabin and the material output transferring cabin, the invention overcomes the problems and deficiencies in the prior art that the cleanness of the environment of the pharmaceutical processing area is difficult to meet the standard requirements. The device for dust removal through air curtain isolation and self-circulation purification provided by the invention isolates dust produced by the processing equipment in the area where it is produced and removes it at the moment when it is produced by means of air curtain isolation and self-circulation purification, thereby avoiding the spreading of dust resulting in pollution and interference to the environment of both the processing area and the whole clean area and facilitating the cleanness of the pharmaceutical processing environment to meet the standard requirements in the Chinese GMP Version 2010.

Brief Description of the Drawings

[0039]

Fig. 1 is a structure diagram of a device in accordance with the embodiment of the present invention; Fig. 2 is a top plan view of Fig. 1; Fig. 3 is a sectional view of Fig. 2 in direction A-A.

Detailed description of the preferred embodiment

[0040] To enable a further understanding of the innovative and technological content of the invention herein, refer to the detailed description of the invention and the accompanying drawings below:

[0041] As shown in Fig. 1 to Fig. 3, as a preferred embodiment of the invention, the device for dust removal through air curtain isolation and self-circulation purification comprises a material input transferring cabin 1, a main isolation cabin 2 for placing and isolating a processing equipment 6, a material output transferring cabin 3 and a control cabinet 7.

[0042] The main isolation cabin 2 is a sealed cabin surrounded by walls, the material input transferring cabin

1 and the material output transferring cabin 3 are respectively disposed on left side and right side of the main isolation cabin 2, the main isolation cabin 2 is connected to the material input transferring cabin 1 through a material inlet 11 that is formed on a wall between the main input transferring cabin 1 and the main isolation cabin 2, and the main isolation cabin 2 is connected to the material output transferring cabin 3 through a material outlet 31 that is formed on a wall between the main isolation cabin and the material output transferring cabin.

[0043] The material input transferring cabin 1 is connected to other external facilities through a material input hole 111 formed on a left wall of the material input transferring cabin 1, and the material output transferring cabin 3 is connected to outside through a material output hole 311 formed on a right wall of the material output transferring cabin 3.

[0044] The control cabinet 7 contains an automatic control device for adjusting, displaying, and recording air volume, pressure differential, and a number of suspended particles in the main isolation cabin 2, the material input transferring cabin 1 and the material output transferring cabin 3.

[0045] All the walls are made from transparent glass or transparent organic glass sheets, and the edge of each wall comprises a metal frame.

[0046] A first laminar flow filtering hood 5, a second laminar flow filtering hood 51 and a third laminar flow filtering hood 52 connect to and seal respectively a top of the main isolation cabin 2, a top of the material input transferring cabin 1 and a top of the material output transferring cabin 3, the first laminar flow filtering hood has an air supply surface, a first air inlet is formed on a sidewall of the second laminar flow filtering hood 51, and a second air inlet is formed on a sidewall of the third laminar flow filtering hood 52; and each wall of the main isolation cabin 2 has a bottom and a plastic plate sealing off the bottom of the four walls to isolate the main isolation cabin 2 from the ground, and, the air passages are formed between the lower portions of the walls of the material input transferring cabin 1 and the material output transferring cabin 3, excepting the wall adjacent to the main isolation cabin 2, and the ground.

[0047] The processing equipment 6 is placed inside the main isolation cabin 2, a waste container 23 with an open top and a lower interface is placed inside the main isolation cabin 2 below the processing equipment 6, the waste container 23 has a funnel shape and a lower portion for collecting dust of large particles, the lower interface 23a of the waste container enables the main isolation cabin 2 to communicate with the lower end of the self-circulation air pipe 21, and the lower interface 23a of the waste container 23 is enabled to pass through the front wall of the main isolation cabin 2 to communicate with the lower end of the self-circulation air pipe 21.

[0048] A plurality of filters and a fan are placed inside the self circulation air pipe 21, the filters in the self-circulation air pipe 21 comprise a plug-board coarse-efficiency

filter 24 and a plug-board medium-efficiency filter 25, the upper end of the self-circulation air pipe 21 connects to the first laminar flow filtering hood 5, and the lower end of the self-circulation air pipe 21 connects to the lower interface 23a of the waste container 23; and a sealed door 42 and a glove box 41 are disposed on the back wall of the main isolation cabin 2.

[0049] The top of each of the front wall and back wall of the main isolation cabin 2 is sealingly attached to the first laminar flow filtering hood 5, and only the bottom of the front wall and back wall of the main isolation cabin 2 are sealingly attached to a workbench; the top of each of the walls of the main isolation cabin 2 adjacent to the material input transferring cabin 1 and the material output transferring cabin 3 is sealingly attached to the first laminar flow filtering hood 5, the bottom of the walls of the main isolation cabin 2 are not sealingly attached to a workbench, and the material inlet 11 and the material outlet 31 are respectively formed on the walls.

[0050] An inlet reduction spreader plate 12 with a top portion and a lower portion and an outlet reduction spreader plate 32 with a top portion are installed inside the main isolation cabin 2 in parallel with left and right walls of the main isolation cabin 2 respectively, a first gap interlayer is placed between the inlet reduction spreader plate 12 and the left wall of the main isolation cabin 2 forming an inlet spreader air curtain passage, and a second gap interlayer is placed between the outlet reduction spreader plate 32 and the right wall of the main isolation cabin 2 forming an outlet spreader air curtain passage; the vertical edge of the inlet reduction spreader plate 12 and the outlet reduction spreader plate 32 is sealingly connected to the front wall and back wall of the main isolation cabin 2, respectively; the top portions of the inlet reduction spreader plate 12 and the outlet reduction spreader plate 32 are close to the air supply surface of the laminar flow filtering hood 5, and the lower portions of the inlet reduction spreader plate 12 and the outlet reduction spreader plate 32 are respectively provided with a reduction plate inlet 112 and a reduction plate outlet 312 at positions corresponding to the material inlet 11 and the material outlet 31.

[0051] The working process of the present invention is as follows:

[0052] During processing, the processing equipment 6 is placed inside the main isolation cabin 2; and the material is fed into the main isolation cabin 2 through the material input hole 111, the material input transferring cabin 1, the material input hole 11, the inlet spreader air curtain passage 26 and the reduction plate inlet 112, processed by the processing equipment 6, and then output from the reduction plate outlet 312, the outlet spreader air curtain passage 27 and the material outlet 31 through the material output transferring cabin 3 and the material output hole 311.

[0053] Air flows in each isolation cabin as below: air in the top portion of the clean room is directly extracted by the second laminar flow filtering hood 51 in the material

input transferring cabin 1 and the third laminar flow filtering hood 52 in the material output transferring cabin 3, and then filtered by the respective high-efficiency filters thereof to form a vertically downwards laminar flow which is called the isolation air curtain inside the material input transferring cabin 1 and the material output transferring cabin 3; and then, the airflow of the isolation air curtain returns back to the clean room from the air passage between the bottom of the material input transferring cabin 1 and the material output transferring cabin 3, and the ground.

[0054] Dust-contained air inside the main isolation cabin 2 is pumped into the self-circulation air pipe 21 by the fan in the first laminar flow filtering hood 5, and then filtered by the coarse-efficiency, medium-efficiency and high-efficiency filters to form a vertical laminar flow below the first laminar flow filtering hood 5, most air enters into the working area of the processing equipment 6 inside the main isolation cabin 2, a small amount of air forms a vertically downwards laminar flow in the inlet spreader air curtain passage 26 and the outlet spreader air curtain passage 27 due to the spreading of the inlet reduction spreader plate 12 and the outlet reduction spreader plate 32 to form a spreader air curtain, and, the clean air from the spreader air curtain flows downward and is pumped into the main isolation cabin from the reduction plate inlet 112 and a reduction plate outlet 312, to compensate the spreading loss of the total air supply amount from the first laminar flow filtering hood 5 on the top of the main isolation cabin 2.

[0055] There may be slight dispersion or mix between the spreader air curtain at the reduction plate inlet 112 and the isolation air curtain inside the material input transferring cabin 1 and also slight dispersion or mix between the spreader air curtain at the reduction plate outlet 312 and the isolation air curtain inside the material output transferring cabin 3, due to the relatively negative pressure formed between the main isolation cabin 2 and the reduction plate inlet 112 and reduction plate outlet 312, the clean air from the isolation air curtain is forced to enter into the main isolation cabin 2 in one direction, thereby guaranteeing a sterile environment inside the main isolation cabin 2 and also isolating and preventing dust produced by the processing equipment 6 in the main isolation cabin 2 from spreading to the clean room; both the dust-contained air at the lower portion of the main isolation cabin 2 and the air supplemented through the reduction plate inlet 112 and reduction plate outlet 312 are pumped into the self-circulation air pipe 21, then filtered off coarse dust by the plug-board coarse-efficiency filter 24 and the plug-board medium-efficiency filter 25, and finally filtered by the first laminar flow filtering hood 5 to circularly flow inside the main isolation cabin 2 and the self-circulation air pipe 21; wherein, large particle of dust is collected in the bottom of the waste container 23, and small particle of dust is filtered off by the plug-board coarse-efficiency filter 24 and the plug-board medium-efficiency filter 25; in this way, dust produced by the

processing equipment 6 is isolated in the area where it is produced and removed at the moment when it is produced.

[0056] The glove box 41 and the sealed door 42 are arranged such that, when the processing equipment 6 needs manual intervention, the operator may perform intervention to the processing equipment 6 in the main isolation cabin 2 through rubber gloves in the glove box 41; and at the end of processing, the operator may open the sealed door 42 to clean, sterilize and maintain the main isolation cabin 2 and the equipment therein.

Claims

1. A device, for dust removal through air curtain isolation and self-circulation purification, comprising:

a material input transferring cabin (1);
 a main isolation cabin (2), having a front wall, a back wall, a left wall, and a right wall, for placing and isolating a processing equipment (6) which is placed inside the main isolation cabin (2), each wall has a top and a bottom, the main isolation cabin (2) being connected to the material input transferring cabin (1) through a material inlet (11) that is formed on a wall between the main input transferring cabin (1) and the main isolation cabin (2);
 a material output transferring cabin (3) connected to the main isolation cabin (2) through a material outlet (31) that is formed on a wall between the main isolation cabin and the material output transferring cabin; and
 a control cabinet (7) containing an automatic control device for adjusting, displaying, and recording air volume, pressure differential, and a number of suspended particles in the main isolation cabin, the material input transferring cabin, and the material output transferring cabin;
characterized in that,
 the main isolation cabin (2) is a sealed cabin surrounded by walls, the material input transferring cabin (1) and the material output transferring cabin (3) are respectively disposed on left side and right side of the main isolation cabin (2), a material input hole (111) is formed on a left wall of the material input transferring cabin (1), a material output hole (311) is formed on a right wall of the material output transferring cabin (3);
 a first laminar flow filtering hood (5), a second laminar flow filtering hood (51) and a third laminar flow filtering hood (52) connect to and seal respectively a top of the main isolation cabin (2), a top of the material input transferring cabin (1), and a top of the material output transferring cabin (3), the first laminar flow filtering hood has an

air supply surface,
 a first air inlet is formed on a sidewall of the second laminar flow filtering hood (51) and a second air inlet is formed on a sidewall of the third laminar flow filtering hood (52), a first air passage is formed between a bottom of the material input transferring cabin (1) and the ground, a second air passage is formed between a bottom of the material output transferring cabin (3) and the ground;

a self-circulation air pipe (21) with a lower end and an upper end is vertically attached to the front wall of the main isolation cabin (2), a waste container (23) with an open top and a lower interface is placed inside the main isolation cabin (2) below the processing equipment (6), the lower interface (23a) of the waste container enables the main isolation cabin (2) to communicate with the lower end of the self-circulation air pipe (21); a plurality of filters and a fan are placed inside the self circulation air pipe, the upper end of the self-circulation air pipe (21) connects to the first laminar flow filtering hood (5), and the lower end of the self-circulation air pipe (21) connects to the lower interface (23a) of the waste container (23);

an inlet reduction spreader plate (12) with a top portion and a lower portion and an outlet reduction spreader plate (32) with a top portion are installed inside the main isolation cabin (2) in parallel with left and right walls of the main isolation cabin (2) respectively, a first gap interlayer is placed between the inlet reduction spreader plate (12) and the left wall of the main isolation cabin (2) forming an inlet spreader air curtain passage, a second gap interlayer is placed between the outlet reduction spreader plate (32) and the right wall of the main isolation cabin (2) forming an outlet spreader air curtain passage, the top portions of the inlet reduction spreader plate (12) and the outlet reduction spreader plate (32) are close to the air supply surface of the laminar flow filtering hood (5), the lower portions of the inlet reduction spreader plate (12) and the outlet reduction spreader plate (32) are respectively provided with a reduction plate inlet (112) and a reduction plate outlet (312) at positions corresponding to the material inlet (11) and the material outlet (31).

2. The device for dust removal according to claim 1, **characterized in that** each wall of the main isolation cabin (2) has a bottom and a plastic plate sealing off the bottom of the four walls to isolate the main isolation cabin (2) from the ground, and, the air passages are formed between the lower portions of the walls of the material input transferring cabin (1) and the material output transferring cabin (3), excepting the

wall adjacent to the main isolation cabin (2), and the ground.

3. The device for dust removal according to claim 1, **characterized in that** the filters in the self-circulation air pipe (21) comprise a plug-board coarse-efficiency filter (24) and a plug-board medium-efficiency filter (25).
4. The device for dust removal according to claim 1, **characterized in that** the waste container (23) has a funnel shape and a lower portion for collecting dust of large particles.
5. The device for dust removal according to claim 1, **characterized in that** a sealed door (42) and a glove box (41) are disposed on the back wall of the main isolation cabin (2).
6. The device for dust removal according to claim 1, **characterized in that** the top of each of the front wall, back wall, left wall, and right wall of the main isolation cabin (2) are sealingly attached to the first laminar flow filtering hood (5), and only the bottom of the front wall and back wall of the main isolation cabin (2) are sealingly attached to a workbench.
7. The device for dust removal according to claim 1, **characterized in that** edges of the inlet reduction spreader plate (12) and the outlet reduction spreader plate (32) are respectively sealingly attached to the front wall and back wall of the main isolation cabin (2).
8. The device for dust removal according to claim 1, **characterized in that** all the walls are made from transparent glass or transparent organic glass sheets, and the edge of each wall comprises a metal frame.
9. A device, for dust removal through air curtain isolation and self-circulation purification, comprising a material input transferring cabin (1) with a bottom, a main isolation cabin (2), with a center, a front wall, a back wall, a left wall, and a right wall, each wall has a top and a bottom, attached to the material input transferring cabin and containing an processing equipment (6), a material output transferring cabin (3), with a bottom, attached to the main isolation cabin, and a control cabinet (7) attached to the material output transferring cabin (3); **characterized in that** the main isolation cabin (2) is a sealed cabin surrounded by walls, the material input transferring cabin (1) and the material output transferring cabin (3) are respectively disposed on left side and right side of the main isolation cabin (2), a material input hole (111) is formed on a left wall of the material input transferring cabin (1), a material

output hole (311) is formed on a right wall of the material output transferring cabin (3), a material inlet (11) is formed on a wall between the main isolation cabin (2) and the material input transferring cabin (1) and enables communication between the main isolation cabin (2) and the material input transferring cabin (1), and a material outlet (31) is formed on a wall between the main isolation cabin (2) and the material output transferring cabin (3) and enables communication between the main isolation cabin (2) and the material output transferring cabin (3);

the control cabinet (7) is an automatic control device for adjusting, displaying, and recording air volume, pressure difference and a number of suspended particles in the main isolation cabin (2), the material input transferring cabin (1), and the material output transferring cabin (3);

a first laminar flow filtering hood (5), a second high-efficiency laminar flow filtering hood (51) and a third high-efficiency laminar flow filtering hood (52) are respectively sealingly attached to top of the main isolation cabin (2), the material input transferring cabin (1) and the material output transferring cabin (3), an air inlet is formed on each of the second filtering laminar high-efficiency flow hood (51) and the third high-efficiency laminar flow filtering hood (52), and a first air passage is formed between the bottom of the material input transferring cabin (1) and the ground, a second air passage is formed between the bottom of the material output transferring cabin (3) and the ground;

the processing equipment (6) is disposed in the center of the main isolation cabin (2), a self-circulation air pipe (21), with a middle, a lower end, and an upper end, is vertically attached to the front wall of the main isolation cabin (2), a waste container (23) with a top opening is disposed inside the main isolation cabin (2) and below the processing equipment (6), the waste container (23) is provided with a lower interface (23a) facing the front wall of the main isolation cabin (2) and allowing communication with a lower end of the self-circulation air pipe (21);

the self-circulation air pipe (21) is provided with a plurality of filters and a fan placed respectively at the middle and the upper end of the self-circulation air pipe (21), the self-circulation air pipe communicates with the first high-efficiency laminar flow filtering hood (5), and the lower end of the self-circulation air pipe (21) is in communication with the lower interface (23a) of the waste container (23);

an inlet reduction spreader plate (12) and an outlet reduction spreader plate (32) are disposed inside the main isolation cabin (2) in parallel, respectively, with the left wall and the right wall of the main isolation cabin (2), a first gap interlayer is formed between the inlet reduction spreader plate (12) and the left wall of the main isolation cabin (2) and a second gap interlayer is formed between the outlet reduction

spreader plate (32) and the right wall of the main isolation cabin (2), the first gap interlayer and the second gap interlayer form an inlet spreader air curtain passage (26) and an outlet spreader air curtain passage (27), top portions of the inlet reduction spreader plate (12) and the outlet reduction spreader plate (32) are adjacent to an air supply surface on the high-efficiency laminar flow filtering hood (5), and lower portions of the inlet reduction spreader plate (12) and the outlet reduction spreader plate (32) are respectively provided with a reduction plate inlet (112) and a reduction plate outlet (312) at positions corresponding to the material inlet (11) and the material outlet (31);

the main isolation cabin (2) has four walls, each wall has a bottom, and a plastic plate sealing off the bottoms of the four walls to isolate the main isolation cabin (2) from the ground, and, the air passages are formed between the lower portions of the walls of the material input transferring cabin (1) and the material output transferring cabin (3), excepting the wall adjacent to the main isolation cabin (2), and the ground;

the filters in the self-circulation air pipe (21) comprise a plug-board coarse-efficiency filter (24) and a plug-board medium-efficiency filter (25);

the waste container (23) has a funnel shape and a caisson shape lower portion for collecting dust of large particles;

a sealed door (42) and a glove box (41) are disposed on the back wall of the main isolation cabin (2);

the top of each wall of the main isolation cabin (2) is sealing attached to the first high-efficiency laminar flow filtering hood (5), and the bottoms of the front wall and back wall of the main isolation cabin (2) are sealing attached to a workbench;

edges of the inlet reduction spreader plate (12) and the outlet reduction spreader plate (32) are respectively sealing attached to the front wall and back wall of the main isolation cabin (2);

all the walls are made from transparent glass or transparent organic glass sheets, and the edge of each wall comprises a metal frame.

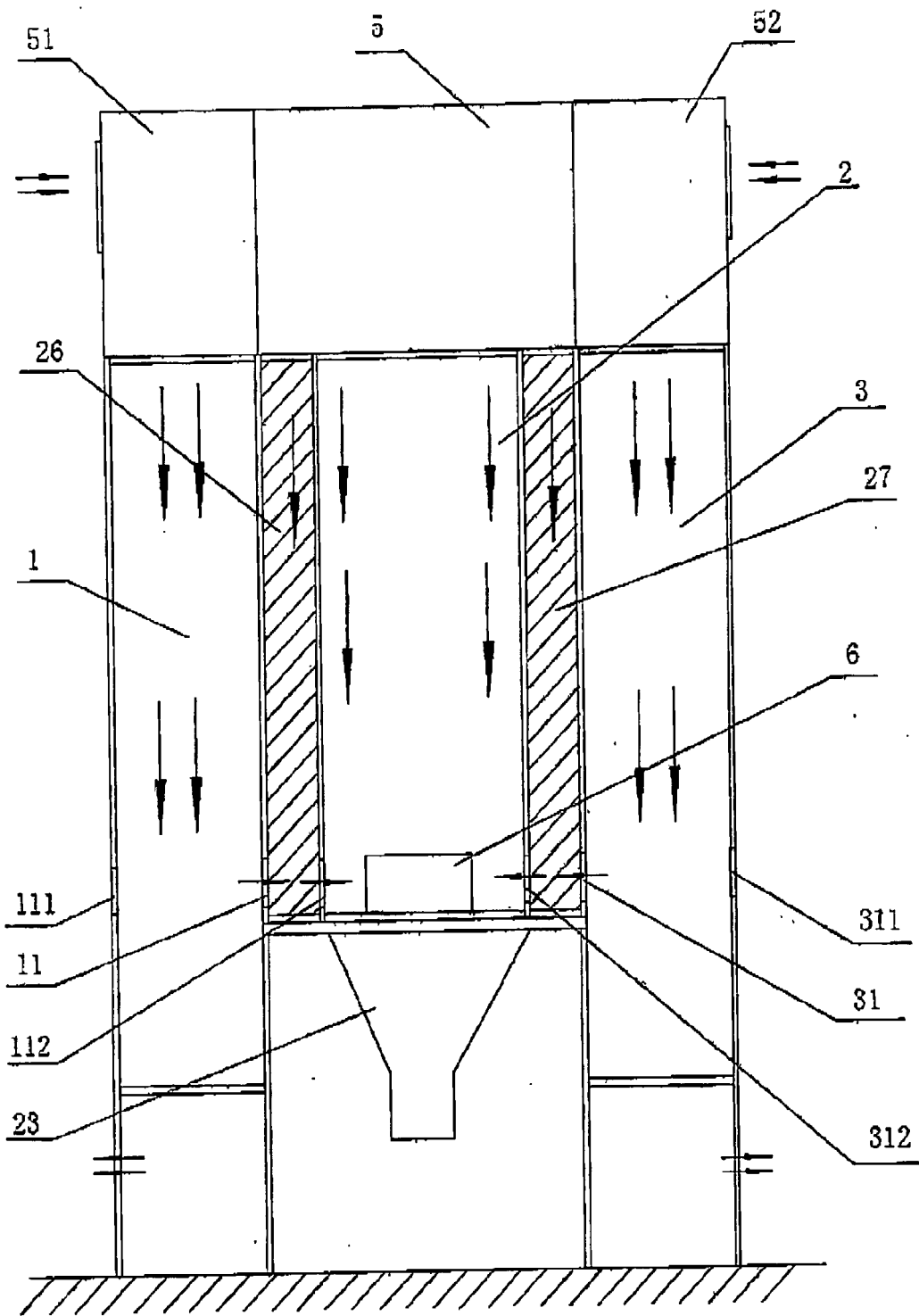


Figure 1

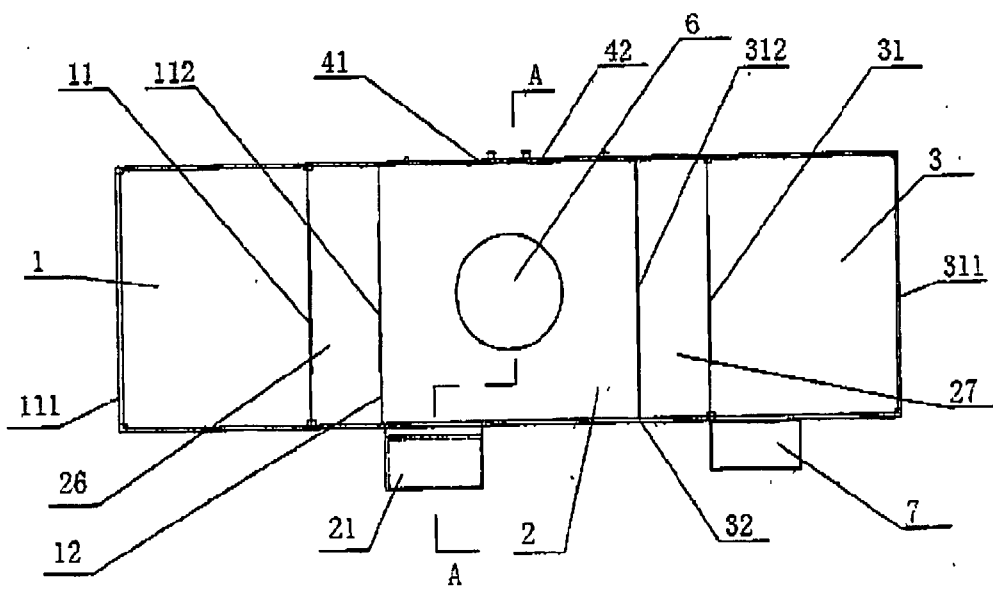


Figure 2

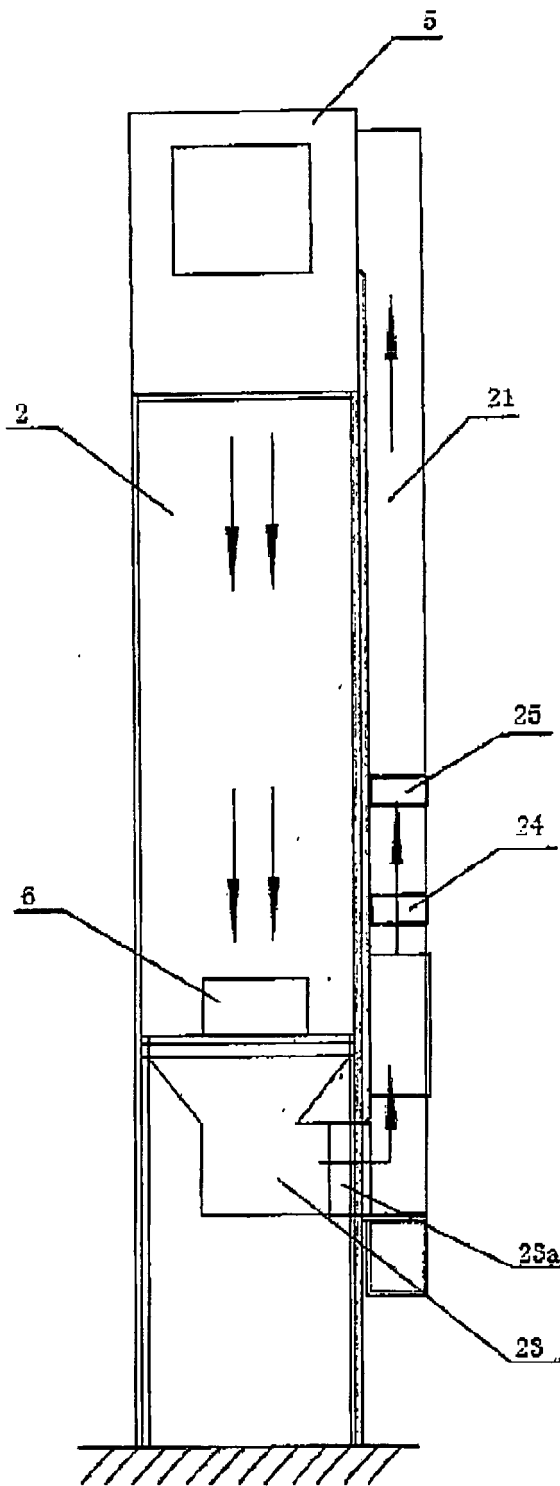


Figure 3

INTERNATIONAL SEARCH REPORT

International application No. PCT/CN2012/000603
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A. CLASSIFICATION OF SUBJECT MATTER		
See the extra sheet		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC: B67C7/00; B01D46/-		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
WPI, EPODOC, CNPAT, CNKI: chamber?, cabin+, dust??. scraps?, separate+, remov+, curtain, gas+, wind, filtrate+		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN102219174A (ZHEJIANG WEIXIN BIOLOG PHARMACEUTICAL CO. LTD.)19 Oct.2011(19.10.2011)description, pages1-6, figures1-3	1-9
PX	CN202046862U (ZHEJIANG WEIXIN BIOLOG PHARMACEUTICAL CO. LTD.)23 Nov.2011(23.11.2011) description, pages1-6, figures1-3	1-9
A	CN101855163A (SIDEL PARTICIPATIONS)06 Oct.2010(06.10.2010) the whole document	1-9
A	US2005/0188651A1 (CLUSSE RATH, Ludwig) 01 Sep.2005(01.09.2005) the whole document	1-9
A	CN101804958A (ZHEJIANG WEIXIN BIOLOG PHARMACEUTICAL CO. LTD.)18 Aug.2010(18.08.2010) the whole document	1-9
A	CN86104465A (PUBLIC HEALTH LOGIS)26 Aug.1987(26.08.1987) the whole document	1-9
A	CN101722165A (TRINC ORG)09 Jun.2010(09.06.2010) the whole document	1-9
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents:	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention “A” document defining the general state of the art which is not considered to be of particular relevance “E” earlier application or patent but published on or after the international filing date “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) “O” document referring to an oral disclosure, use, exhibition or other means “P” document published prior to the international filing date but later than the priority date claimed “X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone “Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art “&”document member of the same patent family	
Date of the actual completion of the international search	Date of mailing of the international search report	
17 Jul. 2012(17.07.2012)	16 Aug. 2012 (16.08.2012)	
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10)62019451	Authorized officer LU, Shuai Telephone No. (86-10)62413037	

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2012/000603

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN102219174A	19.10.2011	none	
CN202046862U	23.11.2011	none	
CN101855163A	06.10.2010	FR2923474A1	15.05.2009
		WO2009062863A2	22.05.2009
		US2010252142A1	07.10.2010
		EP2209734A2	28.07.2010
		MX2010004603A	09.06.2010
		JP2011502900A	27.01.2011
US2005/0188651A1	01.09.2005	EP1561722A1	10.08.2005
		JP2005219813A	18.08.2005
		DE102004005342A1	01.09.2005
		RU2005102667A	10.07.2006
CN101804958A	18.08.2010	none	
CN86104465A	26.08.1987	none	
CN101722165A	09.06.2010	EP2177277A1	21.04.2010
		US2010088830A1	15.04.2010
		JP2010095267A	30.04.2010

Form PCT/ISA /210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/000603

CLASSIFICATION OF SUBJECT MATTER

B67C7/00 (2006.01)i

B01D46/00(2006.01)i